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*North Carolina Department of Transportation  
Division of Highways  
Statewide Planning Branch*

# **THOROUGHFARE PLAN STUDY TECHNICAL REPORT FOR THE TOWN OF ZEBULON**



**PRELIMINARY - NOVEMBER, 1991  
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**THOROUGHFARE PLAN STUDY  
TECHNICAL REPORT  
FOR THE  
TOWN OF ZEBULON**

Prepared by the:  
Urban Planning Unit  
Statewide Planning Branch  
Division of Highways  
North Carolina Department of Transportation

In Cooperation with:  
The Town of Zebulon  
The Federal Highway Administration  
U.S. Department of Transportation

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## ACKNOWLEDGMENTS

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## EXECUTIVE SUMMARY

This report documents the 1991 Zebulon Thoroughfare Plan Study. It is intended to document previous work that has taken place and put closure to the study. With the exception of the Executive Summary, Table 2, and the Public Involvement section, it has not been updated to reflect any additional study that has taken place since that time. With the development of the Triangle Regional Model and the Capital Area Metropolitan Planning Organization's (CAMPO) transportation plan update that will be taking place over the next few years it is desirable to look at the Zebulon area in conjunction with the region as a whole.

This report was not previously published due to a desire to work out differences between NCDOT and the Town of Zebulon concerning the recommended thoroughfare plan. On June 19, 1990 NCDOT in cooperation with the Town of Zebulon held a public workshop to allow local and State staff to meet with the public one-on-one to discuss the recommended plan. The first plan was presented to the Board of Commissioners on July 2, 1990. After input from the Commissioners and local businesses the recommended plan was modified to address their concerns while still meeting the future transportation needs of the Town of Zebulon. This resulted in the recommended plan dated September 17, 1990. A public hearing was held on this plan on March 4, 1991; due to strong public opposition the Board did not take action at that time.

During the next several years there was occasional contact between NCDOT and the Town of Zebulon; unfortunately steps were not taken to resolve the outstanding issues on the recommended thoroughfare plan. In the spring of 1996 local staff contacted NCDOT and requested assistance in locating a corridor for a NC 96 Bypass. Statewide Planning met with the Zebulon staff on April 11, 1996 to discuss the development of a functional design. A functional design using the location of the September 17, 1990 recommended plan as a starting point was developed by Statewide Planning with an emphasis being made to minimize disruption to proposed development west of Zebulon while keeping out of potential wetlands associated with the Little River.

A preliminary functional design was presented to the Zebulon staff on November 13, 1996. Due to the amount of development in the area, and the disruption this facility would have on proposed development, the Town requested an alignment be analyzed east of the Town of Zebulon. Statewide Planning looked at the current development, proposed development, areas of anticipated growth, and the amount of through traffic that would use the proposed Bypass. Based on our analysis, a Bypass east of Town could not be justified. Through traffic alone does not justify the Bypass. Development that has occurred and is proposed in the area, is west of Town and are anticipated to be the principle users of the Bypass.

At this point is necessary to reevaluate the transportation needs of the Town of Zebulon. The information in this report may be outdated but represents a historical record of the previous study. Statewide Planning should continue working with the Town of Zebulon as development continues to be strong in the area. At this time, however, it is the best use of staff resources to devote more time to the development of the Triangle Regional Model.





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## I. INTRODUCTION

The Town of Zebulon is located in eastern Wake County, approximately twenty miles east of Raleigh in the heartland of North Carolina. It is the home of the class AA Mudcats, a professional baseball team new to this area.

Zebulon offers a small town environment with the convenience of Raleigh, the second largest urbanized area in North Carolina, not very far away. Zebulon is the home of Triangle East of North Carolina, Inc., a group that attracts business and industry to Wilson, Rocky Mount, Zebulon, and surrounding areas.

There are many and varied benefits to be derived from thoroughfare planning, but the primary objective is to enable the urban street system to be progressively developed in a manner which will adequately service future traffic demands in the Zebulon area. In addition, the thoroughfare plan should embody those details of accepted thoroughfare planning principles. Major and minor thoroughfares were located based on field investigation, aerial photos, existing and anticipated land uses, and topographic conditions.

Some of the major benefits to be derived from thoroughfare planning are:

- (a) A minimum amount of land will be required for street and highway purposes.
- (b) Local citizens will know which streets will be developed as major thoroughfares and thus will have assurance that their residential street will not one day become a major traffic carrier.
- (c) Land developers will be able to design their subdivisions so that subdivision streets will function in a non-conflicting manner with the overall plan.

It should be emphasized that the recommended plan is based on anticipated growth of the urban area as indicated by current trends. Prior to construction of specific projects, a more detailed study will be required to reconsider development trends and to determine specific locations and design requirements.



## II. THOROUGHFARE PLANNING PRINCIPLES

### Objectives

Typically, the urban street system occupies 25 to 30 percent of the total developed land in an urban area. Since the system is permanent and expensive to build and maintain, much care and foresight are needed in its development. Thoroughfare planning is the process public officials use to assure the development of the most appropriate street system that will meet existing and future travel desires within the urban area.

The primary aim of a thoroughfare plan is to guide the development of the urban street system in a manner consistent with the changing traffic patterns. A thoroughfare plan will enable street improvements to be made as traffic demands increase, and it helps eliminate unnecessary improvements, so needless expense can be averted. By developing the urban street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained, requiring a minimum amount of land for street purposes. In addition to providing for traffic needs the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present and future population, commercial, and industrial development affects major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

1. providing for the orderly development of an adequate major street system as land development occurs,
2. reducing travel and transportation costs,
3. reducing the cost of major street improvements to the public through the coordination of the street system with private action,
4. enabling private interests to plan their actions, improvements, and development with full knowledge of public intent,
5. minimizing disruption and displacement of people and businesses through long range advance planning for major street improvements,
6. reducing environmental impacts, such as air pollution, resulting from transportation, and
7. increasing travel safety.

Thoroughfare planning objectives are achieved through both improving the operational efficiency of thoroughfares, and improving the system efficiency through system coordination and layout.

### Operational Efficiency

A street's operational efficiency is improved by increasing the capability of the street to carry more vehicular traffic and people. In terms of vehicular traffic, a street's capacity is defined by the maximum number of vehicles which can pass a given point on a roadway during a given time period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic, and weather.

Physical ways to improve vehicular capacity include street widening, intersection improvements, improving vertical and horizontal alignment, and eliminating roadside obstacles. For example, widening of a street from two to four lanes more than doubles the capacity of the street by providing additional maneuverability for traffic. This reduces the impedances to traffic flow caused by slow moving or turning vehicles and the adverse effects of horizontal and vertical alignments.

Operational ways to improve street capacity include:

1. Control of access -- A roadway with complete access control can often carry three times the traffic handled by a non-controlled access street with identical lane width and number.
2. Parking removal -- Increases capacity by providing additional street width for traffic flow and reducing friction to flow caused by parking and unparking vehicles.
3. One-way operation -- The capacity of a street can sometimes be increased 20-50%, depending upon turning movements and overall street width, by initiating one-way traffic operations. One-way streets can also improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination.
4. Reversible lanes -- Reversible traffic lanes may be used to increase street capacity in situations where heavy directional flows occur during peak periods.
5. Signal phasing and coordination -- Uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.



Altering travel demand is a third way to improve the efficiency of existing streets. Travel demand can be reduced or altered in the following ways:

1. Encourage people to form carpools and vanpools for journeys to work and other trip purposes. This reduces the number of vehicles on the roadway and raises the people carrying capability of the street system.
2. Encourage the use of transit and bicycle modes.
3. Encourage industries, businesses, and institutions to stagger work hours or establish variable work hours for employees. This will spread peak travel over a longer time period and thus reduce peak hour demand.
4. Plan and encourage land use development or redevelopment in a more travel efficient manner.

### **System Efficiency**

Another means for altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost to the user. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

#### **Functional Classification**

Streets perform two primary functions -- traffic service and land service, which when combined, are basically incompatible. The conflict is not serious if both traffic and land service demands are low. However, when traffic volumes are high, conflicts created by uncontrolled and intensely used abutting property leads to intolerable traffic flow friction and congestion.

The underlying concept of the thoroughfare plan is that it provides a functional system of streets which permits travel from origins to destinations with directness, ease, and safety. Different streets in the system are designed and called on to perform specific functions, thus minimizing the traffic and land service conflict. Streets are categorized as to function as local access streets, minor thoroughfares, or major thoroughfares (See Figure 1).

Local Access Streets provide access to abutting property. They are not intended to carry heavy volumes of traffic and should be located such that only traffic with origins and destinations of the streets would be served. Local streets may be further classified as either residential, commercial, and/or industrial depending upon the type of land use which they serve.

Minor Thoroughfares are more important streets on the city system. They collect traffic from local access streets and carry it to the major thoroughfares. They may in some instances supplement the major thoroughfare system by facilitating minor through traffic movements. A third function that may be performed is that of providing access to abutting property. They should be designed to serve limited areas so that their development as major thoroughfares will be prevented.

Major Thoroughfares are the primary traffic arteries of the city. Their function is to move intra-city and inter-city traffic. The streets which comprise the major thoroughfare system may also serve abutting property, however, their principle function is to carry traffic. They should not be bordered by uncontrolled strip development because such development significantly lowers the capacity of the thoroughfare to carry traffic and each driveway is a danger and an impediment to traffic flow. Major thoroughfares may range from a two-lane street carrying minor traffic volumes to major expressways with four or more traffic lanes. Parking normally should not be permitted on major thoroughfares.

#### Idealized Major Thoroughfare System

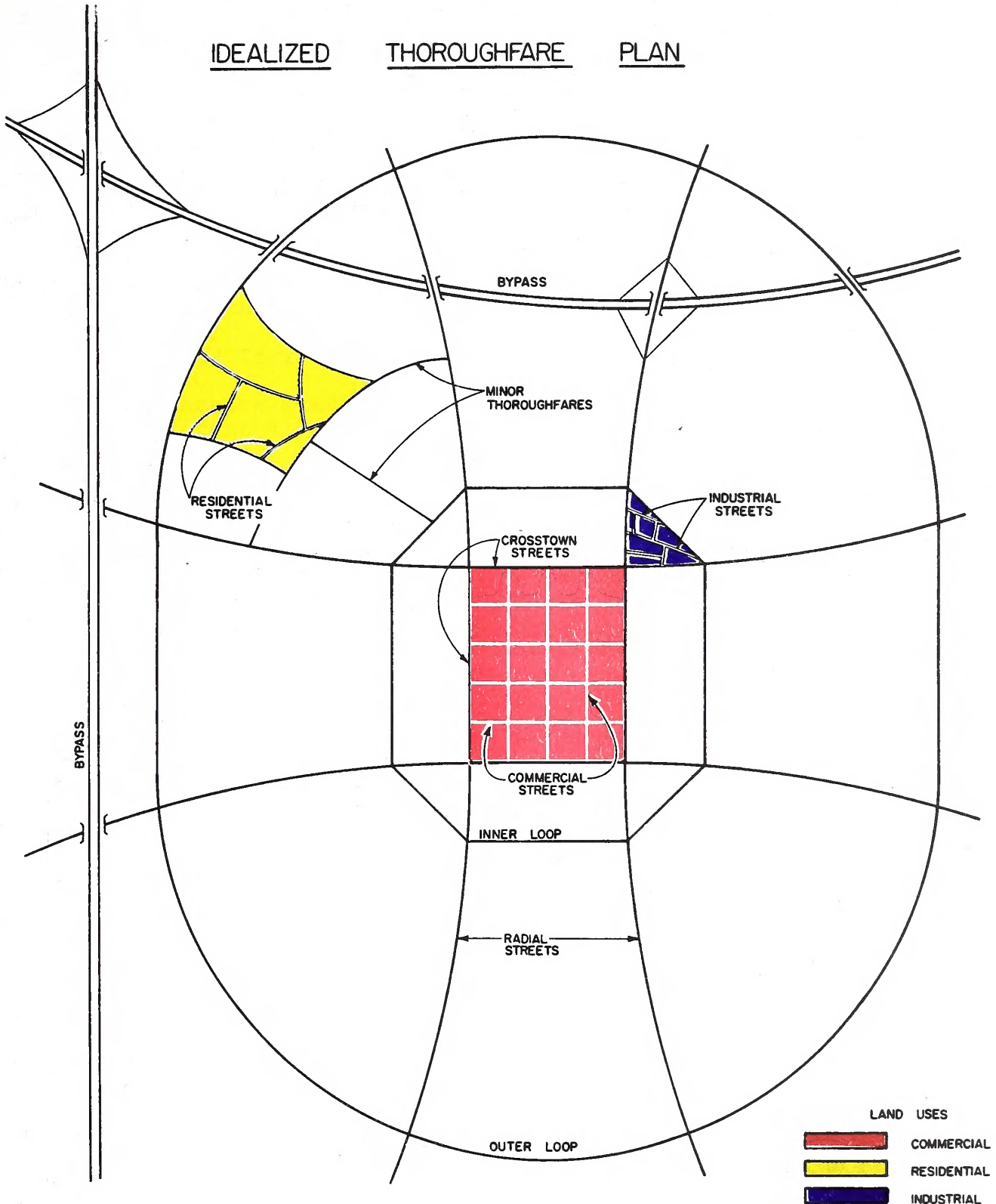
A coordinated system of major thoroughfares forms the basic framework of the urban street system. A major thoroughfare system which is most adaptable to desire lines of travel within an urban area is the radial-loop system. It permits movement between various areas of the city with maximum directness. This system consists of several functional elements--radial streets, crosstown streets, loop system streets, and bypasses (Figure 1).

Radial streets provide for traffic movement between points located on the outskirts of the city and the central area. This is a major traffic movement in most cities, and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

If all radial streets crossed in the central area, an intolerable congestion problem would result. To avoid this problem, it is very important to have a system of crosstown streets which form a loop around the central business district. This system allows traffic moving from origins on one side of the central area to destinations on the other side to follow the area's border. It also allows central area traffic to circle and then enter the area near a given destination. The effect of a good crosstown system is to free the central area of crosstown traffic, thus permitting the central area to function more adequately in its role as a business or pedestrian shopping area.

Loop system streets move traffic between suburban areas of the city. Although a loop may completely encircle the city, a typical trip may be from an origin near a radial thoroughfare to a destination near another radial thoroughfare. Loop streets do not

IDEALIZED    THOROUGHFARE    PLAN



LAND USES




	COMMERCIAL
	RESIDENTIAL
	INDUSTRIAL

FIGURE 1



necessarily carry heavy volumes of traffic, but they function to help relieve central areas. There may be one or more loops, depending on the size of the urban area. They are generally spaced one-half mile to one mile apart, depending on the intensity of land use.

A bypass is designed to carry traffic through or around the urban area, thus providing relief to the city street system by removing traffic which has no desire to be in the city. Bypasses are usually designed to through-highway standards, with control of access. Occasionally, a bypass with low traffic volume can be designed to function as a portion of an urban loop. The general effect of bypasses is to expedite the movement of through traffic and to improve traffic conditions within the city. By freeing the local streets for use by shopping and home-to-work traffic, bypasses tend to increase the economic vitality of the local area.

#### Application of Thoroughfare Planning Principles:

The concepts presented in the discussion of operational efficiency, functional classification, and idealized major thoroughfare system are the conceptual tools available to the transportation planner in developing a thoroughfare plan. In actual practice, a thoroughfare plan is developed for established urban areas and is constrained by the existing land use and street patterns, existing public attitudes and goals, and current expectations of future land use. Compromises must be made because of these constraints and the many other factors that affect major street locations.



### III. EXISTING FACILITIES

#### Major Routes

The Town of Zebulon is located at the intersection of US 64 and US 264. These two freeways border the Town to the north and east providing major access to Raleigh, Wilson, and Rocky Mount. Other major routes are NC 96 and NC 97 which intersect downtown, in the center of Zebulon. These two arterials serve the majority of commercial, residential, and industrial areas in Zebulon.

#### Population Trends

Travel is directly related to population, and the volume of traffic is closely related to the size and distribution of the population which it serves. Table 1 shows population totals and trends for the Wake County, Little River Township, and Zebulon.

Population Trends and Projections			
Year	Wake Co.	Little River Township	Zebulon
1940	109,544	5,912	1,070
1950	136,450	6,331	1,378
1960	169,082	6,053	1,534
1970	228,453	6,714	1,839
1980	301,327	7,449	2,055
1887	374,582	9,365	2,810
1988	384,672 <sup>1</sup>	9,617 <sup>2</sup>	2,885 <sup>3</sup>
1990	402,330 <sup>1</sup>	10,058 <sup>2</sup>	3,017 <sup>3</sup>
2000	501,347 <sup>1</sup>	12,534 <sup>2</sup>	3,760 <sup>3</sup>
2010	592,773 <sup>1</sup>	14,819 <sup>2</sup>	4,446 <sup>3</sup>
2015	645,000 <sup>1</sup>	16,125 <sup>2</sup>	4,838 <sup>3</sup>

<sup>1</sup> Projections for Wake County taken from office of State Budget and Management, State of North Carolina, 1988.

<sup>2</sup> Little River Township projections assumed the same percent in population of Wake County.

<sup>3</sup> Zebulon projections assumed the same rate of percentage in population of Little River Township, and does not take into account future annexations.

**TABLE 1**

As shown in Table 1, population in Zebulon is expected to increase at a compounded annual growth rate of approximately 1.9% per year between 1988 and 2015. However, this increase is conservative because this data does not include future influence of Raleigh outer loop.

The outer loop will intersect US 64 at approximately 12 miles south of the US 64-NC 96 (Zebulon) interchange. Because of this close proximity, Zebulon could expect a higher growth rate than can be projected using current data.

### **Economy and Employment**

Zebulon is a small community located approximately 16 miles east of Raleigh on US 64. Permanent population is approximately 3,000 people. Zebulon has a thriving central business district with approximately twenty-five businesses. Zebulon is the home to Triangle East, a group encouraging industrial development in Zebulon, Rocky Mount, Wilson, and surrounding areas. The employment base is composed mostly of persons employed by the textile industry and by Glaxo, a manufacturer of pharmaceutical products.

### **Travel Demand**

Travel demand is generally reported in the form of average daily traffic counts. Traffic counts are taken regularly at several locations in and around Zebulon by the North Carolina Department of Transportation. To estimate future travel demand, traffic trends over the past fourteen years were studied.

A comparison of annual growth rates from 1975 to 1988 at various count locations in Zebulon shows average annual growth rates ranging from 3% to 8%. The largest growth was noted on US 64 Bypass and NC 96. Appendix A and figures 2 and 3 show existing and expected average traffic volumes based on growth rates of 2.5% (moderate growth) to 3.5% (high growth). The reason this is used instead of the past growth rates is because these projections are being made for twenty-five years. It is very difficult for an area to sustain a annual growth rate over four percent. Likewise, it is uncommon for an area to maintain growth rate less than two percent.

### **Traffic Accidents**

Traffic accident analysis is a serious and important consideration in a thoroughfare plan development. The source of traffic accidents can be broken down into three general categories. The first is the physical environment which includes such things as road condition, weather, road obstructions, and traffic conditions. The second source is associated with the driver. This includes the driver's mental alertness, distractions in the car, ability to handle the vehicle, and reaction time. The third source is associated with the physical attributes of the vehicle itself. This would include such things as the condition of the brakes and tires, vehicle responsiveness, size of the vehicle, and how well the windshield wipers and defroster work. All traffic accidents can be attributed to one or more of these sources; however, the driver is often the primary source.



FIGURE 2

1989 TRAFFIC COUNTS  
(ADT)



TOWN OF  
ZEBULON  
WAKE COUNTY  
NORTH CAROLINA

PREPARED BY THE  
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF PROGRAMS, PLANNING & RESEARCH BRANCH  
IN COOPERATION WITH  
UNITED STATES DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION

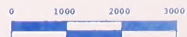




FIGURE 3

PROJECTED TRAFFIC COUNTS

2015 ADT W/O THOROUGHFARE PLAN  
2015 ADT W/ THOROUGHFARE PLAN

-- LEGEND --

- |                     |          |          |
|---------------------|----------|----------|
|                     | EXISTING | PROPOSED |
| MAJOR THOROUGHFARES |          |          |
| MINOR THOROUGHFARES |          |          |
| INTERCHANGES        |          |          |
| GRADE SEPARATIONS   |          |          |
| LONG RANGE MAJOR    |          |          |

ADOPTED BY: US 74

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ADOPTED BY: NORTH CAROLINA DEPARTMENT  
OF TRANSPORTATION

PUBLIC HEARING: MARCH 4, 1992



RECOMMENDED  
THOROUGHFARE PLAN  
FOR THE

TOWN OF  
ZEBULON

WAKE COUNTY  
NORTH CAROLINA

PREPARED BY THE  
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS - PLANNING & RESEARCH BRANCH  
IN COOPERATION WITH  
UNITED STATES DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION

SEPTEMBER 17, 1990





Accident data for January 1993 through November 1996 was studied as part of the development of this report. As expected, because of its high traffic volume the intersection of Arendell Ave. and Gannon Ave. reported the highest accident total. Although this intersection had the most accidents of all others in the area most were very minor with light damage. This seems to be typical in nature of a high capacity intersection and therefore will be noted as being normal. However, the traffic problem in this particular area will be addressed later in this report. For other accident locations see Table 2.

Town Of Zebulon Selected Accident Inventory (January 1993 - November 1996)	
Location	Number of Accidents
Arendell Ave. @ Gannon Ave.	25
Arendell Ave. @ Horton St.	14
Arendell Ave. @ Vance Ave.	14
Arendell Ave. @ Wakeland Dr.	22
Church St. @ Gannon Ave.	13
Gannon Ave. @ Stratford Ave.	10
Horton St. @ Poplar St.	15

**TABLE 2**

### Capacity Analysis

A good indication of the adequacy of the existing major street system is a comparison of the traffic volumes with the ability of the streets to move traffic freely at a desirable speed. The ability of a street to move traffic freely, safely, and efficiently with a minimum delay is controlled principally by the spacing of major devices utilized. Thus, the ability of a street to move traffic can be increased by restricting parking, turning movements, using proper sign and signal devices, and by the application of other traffic engineering techniques.

Capacity is defined as the maximum number of vehicles which has a reasonable expectation of passing over a given section of a roadway in one direction, or in both directions, during a given time period under prevailing roadway and traffic conditions.<sup>1</sup> The relationship of traffic volumes to the capacity of the roadway will determine **level of service** being provided. Six levels of service have been selected to identify the conditions existing under various speed and volume conditions on a highway or street.

The six levels of service are illustrated in Figure 4, and they are defined on the following pages. The definitions are general and conceptual in nature, but may be applied to urban arterial levels of service. Levels of service for interrupted

<sup>1</sup> Highway Capacity Manual, Special Report 209, 1985, p. 1-3.

flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them. Each chapter of the 1985 Highway Capacity Manual contains more detailed descriptions of the levels of service as defined for each facility type.

1. **Level-of-service A** describes primarily free flow-operations at average travel speeds usually about 90 percent of the free flow speed for the arterial class. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Stopped delay at signalized intersections is minimal.
2. **Level-of-service B** represents reasonable unimpeded operations at average travel speeds usually about 70 percent of the free flow speed for the arterial class. The ability to maneuver within the traffic stream is only slightly restricted and stopped delays are not bothersome. Drivers are not generally subjected to appreciable tension.
3. **Level-of-service C** represents stable operations. However, ability to maneuver and change lanes in midblock locations may be more restricted than in LOS B, and longer queues and/or adverse signal coordinations may contribute to lower average travel speeds of about 50 percent of the average free flow speed for the arterial class. Motorists will experience an appreciable tension while driving.
4. **Level-of-service D** borders on a range on which small increases in flow may cause substantial increases in approach delay and, hence, decreases in arterial speed. They may be due to adverse signal progression, inappropriate signal timing, high volumes, or some combination of these. Average travel speeds are about 40 percent of free flow speed.
5. **Level-of-service E** is characterized by significant approach delays and average travel speeds of one-third the free flow speed or lower. Such operations are caused by some combination of adverse progression, high signal density, extensive queuing at critical intersections, and inappropriate signal timing.
6. **Level-of-service F** characterizes arterial flow at extremely low speeds below one-third to one-quarter of the free flow speed. Intersection congestion is likely at critical signalized locations, with high approach delays resulting. Adverse progression is frequently a contributor to this condition.

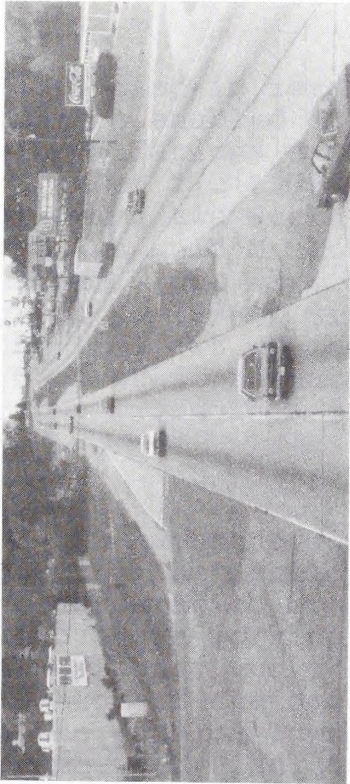
The recommended improvements and overall design of the Thoroughfare Plan were based on achieving a minimum of LOS D on

existing facilities, and LOS C on new facilities. LOS D is considered the "**practical capacity**" of a facility, or that at which the public begins to express dissatisfaction.

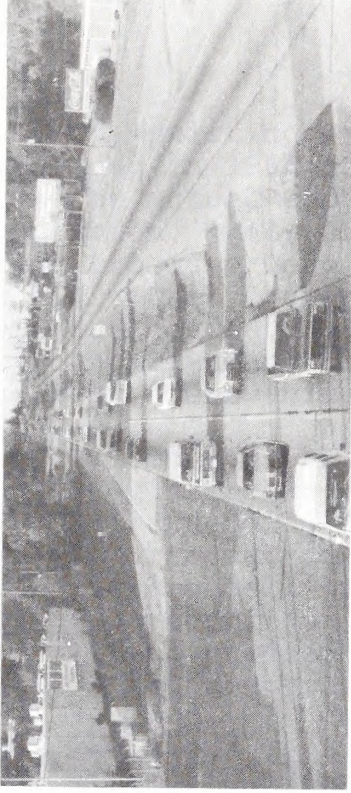
There are two primary locations in the Zebulon area that will experience capacity problems in the future. These locations are Arendell Avenue (NC 96) and Gannon Avenue (NC 97). Due to the nature of these facilities, widening to allow for adequate capacity is not feasible without extensive damage to the neighborhoods and businesses. For this reason several proposals to help alleviate congestion on these facilities are recommended to handle the traffic expected to use these facilities in the future. The proposals that will do the most to handle the projected traffic are the NC 96 Bypass and the Gannon Avenue/Sycamore Street one-way pair. These proposals are discussed in Chapter 4, Recommendations.

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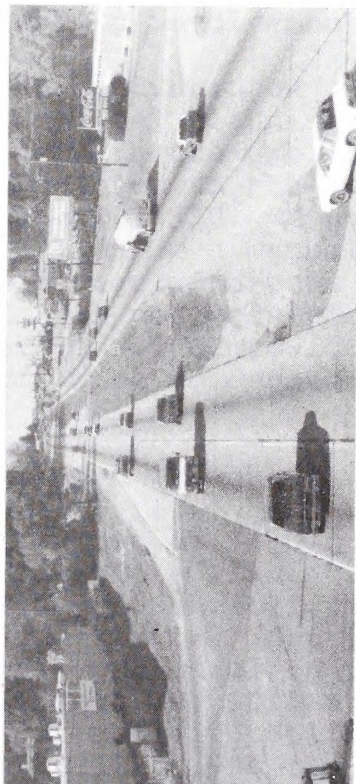




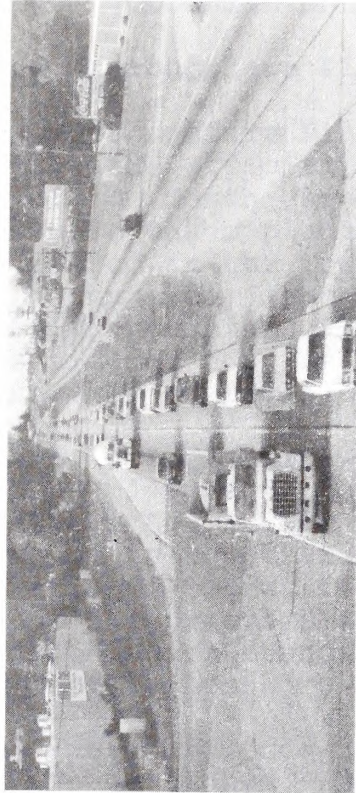
LEVEL OF SERVICE - A



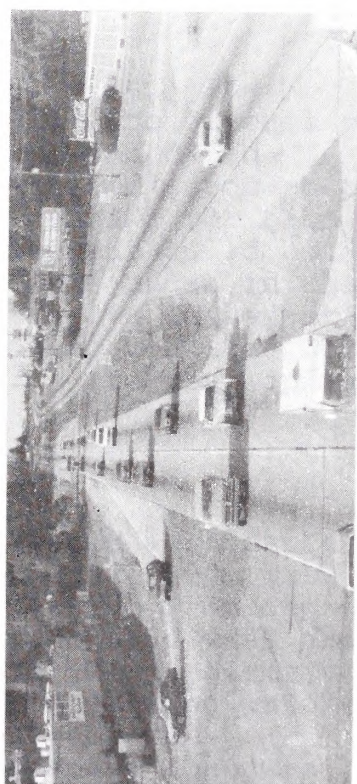
LEVEL OF SERVICE - D



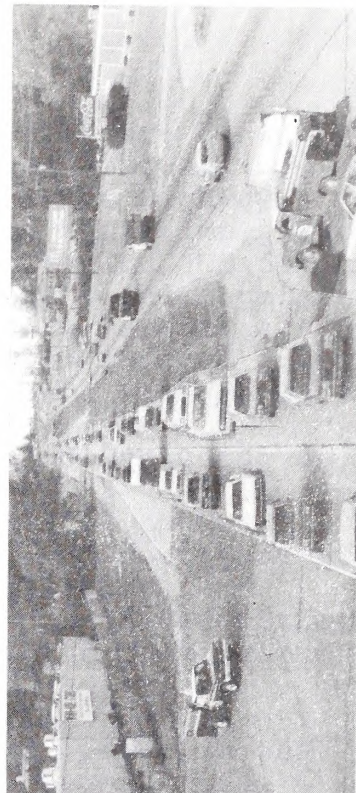
LEVEL OF SERVICE - B



LEVEL OF SERVICE - E



LEVEL OF SERVICE - C



LEVEL OF SERVICE - F

LEVELS OF SERVICE



## **IV. RECOMMENDATIONS**

### **1966 Thoroughfare Plan**

The existing Zebulon Thoroughfare Plan (see Figure 5) was developed in 1966 and became the official plan on February 3, 1967 with the mutual adoption of the North Carolina State Highway Commission. Many changes have taken place since that time. Two major freeways were constructed in the Town of Zebulon, US 64 and US 264. Due to changes in the area, changes in the thoroughfare plan are needed. The 1996 Thoroughfare Plan Study looked at the existing Plan and also considered how the area has changed during the past twenty-nine years. Major revisions to the Plan include:

1. moving the Western Loop further west, and including an interchange with US 64 Bypass,
2. extending the Western Loop north from US 64 to NC 96
3. removal of the major thoroughfare that ran southeast from Arendell Avenue at Judd Street to NC 97, and
4. reconfiguration of the proposed extension of Judd Street to proceed along the south boundary of the Glaxo property to the proposed Western Loop.

Revisions 1, 3, and 4 were made due to development in the area since the 1966 Plan was developed. By looking at these revisions it is easier to understand the need to use the Thoroughfare Plan to protect the integrity of corridors as an area grows.

### **Public Involvement**

A drop-in session was conducted on June 19, 1990. The workshop enabled NCDOT and local planning officials to discuss the recommendations one-on-one with the public. The Plan dated September 17, 1990 was presented to the Board of Commissioners the following two weeks on July 2, 1990. A public hearing for this Plan was held March 4, 1991 where a mutual agreement could not be reached. New work and meetings with town officials began in the Spring of 1996. Since it was not possible to resolve issues at that time, it was the opinion of Statewide Planning that the best use of staff resources would be to devote time to the development of the Triangle Regional Model.

### **Recommended Thoroughfare Plan**

In August of 1989 the Town of Zebulon requested assistance in updating the Zebulon Thoroughfare Plan. In April of 1990, with the cooperation of the Town of Zebulon, the Statewide Planning Group began working on this update. Meetings were held with the Town Planner and other Town personnel to discuss the problems and concerns of the area. On June 19, 1990 a drop-in session was held in the Zebulon Town Hall to solicit public input for the recommended Plan, and on July 2, 1990 the recommended Plan was presented to the Zebulon Town Council. In September 1990 the

recommended Plan was changed to include an interchange with US 64 Bypass and the proposed NC 96 Bypass, as well as removing the western extension of Judd Street and adding the western extension of Franklin Street to follow area property owners boundaries. This became the Recommended Thoroughfare Plan for the Town of Zebulon map dated September 17, 1990 (see Figure 6). A public hearing was held on March 4, 1991. The Zebulon Board of Commissioners has not taken any action on the recommended Plan at this time.

### **Recommendations**

The following is a list of roads that are recommended to serve as major and minor thoroughfares as discussed in Chapter II. A brief discussion of the road's deficiencies and function is included to support its classification as a thoroughfare. More detail on physical and operational characteristics is given in Appendix A, Table 4.

There are many two-lane facilities in the area that are less than 24 feet wide (twelve foot lanes). It is desirable from an operations and safety standpoint that roads with less than 24 feet of pavement be widened to 24 feet. These facilities are given in Appendix A.

### **Major Thoroughfares**

Existing major thoroughfares include:

- US 64 / US 264** - US 64 Bypass and US 264 are four-lane freeway facilities. US 64 runs through the northern section of the Zebulon planning area and US 264 splits off US 64 east of the Town and continues to Wilson. It has been projected that these two freeways will have adequate capacity for the next twenty-five years. However, there is adequate right of way to allow a six-lane freeway if ever needed.
- US 64 Bus.** - Along this two lane facility from the western planning boundary to NC 97, there are no foreseeable capacity problems. From Gannon Avenue (NC 97) to Arendell Avenue (NC 96) there will be capacity problems in the future. This section may be converted to a one-way road thus increasing its ability to handle traffic (see **Gannon Avenue (Widening or One-way Pairs with Sycamore Street)** in the next section). In addition, along Arendell from NC 96 to Judd Street there will be a need for improvements to alleviate traffic problems projected for the design year. Widening US 64 Business from Judd Street to Gannon Avenue to three lanes is possible in the existing right-of-way. Widening this section in addition to improvements denoted on the thoroughfare plan will help alleviate the congestion along this section of road.
- NC 96** - This road is one of the main facilities serving the downtown shopping area. Some of the roadway has adequate



### THOROUGHFARE PLAN

ADOPTED BY ZEBULON ON DECEMBER 5, 1966

RECOMMENDED APPROVAL BY ADVANCE PLANNING  
DEPARTMENT ON DECEMBER 8, 1966

ADOPTED BY NORTH CAROLINA STATE HIGHWAY  
COMMISSION ON FEBRUARY 3, 1967

### LEGEND

MAJOR THOROUGHFARES  
MINOR THOROUGHFARES

EXIST. ALIGN

NEW ALIGN



FIGURE 5

THOROUGHFARE PLAN  
ZEBULON, N.C.  
NOVEMBER 15, 1966

0 500 1000





-- LEGEND --

- |                     |          |          |
|---------------------|----------|----------|
|                     | EXISTING | PROPOSED |
| MAJOR THOROUGHFARES |          |          |
| MINOR THOROUGHFARES |          |          |
| INTERCHANGES        |          |          |
| GRADE SEPARATIONS   |          |          |
| LONG RANGE MAJOR    |          |          |

ADOPTED BY:  
TOWN OF ZEBULON

RECOMMENDED FOR APPROVAL BY:  
NORTH CAROLINA DOT  
PLANNING AND ENVIRONMENTAL BRANCH

ADOPTED BY:  
NORTH CAROLINA DEPARTMENT  
OF TRANSPORTATION

PUBLIC HEARING: MARCH 4, 1991

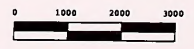


FIGURE 6  
RECOMMENDED  
THOROUGHFARE PLAN  
FOR THE  
TOWN OF  
ZEBULON  
WAKE COUNTY  
NORTH CAROLINA

PREPARED BY THE  
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS, PLANNING & RESEARCH BRANCH

IN COOPERATION WITH  
UNITED STATES DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION

SEPTEMBER 17, 1990







capacity. In the immediate downtown area between Gannon Avenue and Barbee Street, the elimination of on-street parking would allow for an additional lane to be added to create a three lane section. The advantages of this improvement is twofold. First it would increase capacity by eliminating on-street parking and adding a lane. Secondly it would rid the area of safety problems created by the ingress and egress of cars parking on the street.

**NC 97** - Along this facility there are no foreseeable capacity problems, except where common with US 64 Business (see explanation above). It is recommended, however, that some sections be widened to twelve foot lanes.

**Old US 64 (SR 2406)** - Along this two lane facility from NC 97 to the planning boundary, there are no foreseeable capacity problems. Therefore, no improvements are necessary to increase capacity. However, it is recommended that the intersection with NC 97 be improved as recommended in the *Zebulon Traffic Study* prepared by the Traffic Engineering Branch of the North Carolina Department of Transportation.

**Proctor Street, Old Dunn Road, SR 1001** - Along these two lane roads the capacity is adequate for projected future traffic volumes. Therefore, no improvements are necessary. It is recommended, however, that they be widened to twelve foot lanes.

**Wakefield Street** - Along this two lane facility from Gannon Avenue to the planning boundary, there are no foreseeable capacity problems. Therefore, no improvements are necessary. However, it is recommended that some sections along this route be widened to allow for twelve foot lanes.

Proposed new major thoroughfares include:

**Western Loop** - A Western Loop will do a great deal towards alleviating congestion along Arendell Avenue and the western part of town where current development is occurring. Although Arendell may be widened to three lanes, there is insufficient right-of-way to widen it to handle the projected traffic in this area. For such reasons, it is imperative to create an alternative route for traffic in Zebulon, as well as traffic passing through Zebulon (including trucks). An interchange on US 64 Bypass west of Zebulon would allow access to western Zebulon without using Arendell Avenue and Gannon Avenue (the major congestion points in Zebulon). An initial cross-section of two lanes with the option of widening to a four-lane divided boulevard is recommended for this facility. The loop could ultimately serve as a bypass once the thoroughfare is connected with NC 96 south of the planning area. This would allow for a smoother flow of traffic through Zebulon.

**Gannon Avenue (Widening or One-way Pairs with Sycamore Street)** - Future projected volumes along Gannon Avenue warrant a five-

lane road. Widening Gannon Avenue would alleviate traffic congestion along the facility, but would also cause extensive property damage. One of the best ways to handle heavy volumes of traffic is the implementation of one-way streets. Implementation of one-way streets offer increased capacity and increased safety with very little construction cost. The choice to widen or use one-way pairs will be decided locally.

### **Minor Thoroughfares**

Existing minor thoroughfares include:

**Barbee Street** - This facility serves east/west traffic desires south of the central business district. There are no capacity deficiencies anticipated on this facility.

**Green Pace Road** - This facility now serves as a minor thoroughfare and will remain so on the new plan. This facility does not anticipate any capacity problems for the design year. However, it is recommended that this road be widened to accommodate twelve foot travel lanes.

**Horton Street** - This facility will serve as a connector across town from Wakefield Avenue to the Horton St. Extension. It is recommended that this facility be relocated forming a T-intersection with Horton St. Extension to create a safe intersection. Capacity problems are not anticipated.

**Franklin Street** - Franklin Street serves the residential area it passes through, as well as through traffic from the northside of town near US 64 to the south and western parts of Zebulon. Through traffic in the future is likely to be heavy along this facility if a minor thoroughfare is not built just to the north of Franklin Street to serve the flow of traffic.

**Wakefield Street (north of NC 97)** - This two-lane facility primarily serves the residential area it passes through. It also serves as an alternative route for traffic on Arendell Avenue and Gannon Avenue. There are no capacity problems projected for this road; However, widening this facility to thirty-two feet of pavement with curb and gutter is recommended. This will allow for twelve feet travel lanes with additional space for parking or breakdown lane.

**Whitley Avenue** - This facility serves north/south traffic desires east of downtown Zebulon. There are no capacity deficiencies anticipated on this facility.

Proposed new minor thoroughfares include:

**Barbee Street** - The extension of Barbee Street to Horton Street

Extension will create a continuous east/west facility serving traffic south of Zebulon. It is recommended that this be a two-lane facility.

**Judd Street** - The extension of Judd Street to the Western Loop will serve the residential areas north of Gannon Avenue. It will allow for east/west travel without using Gannon Avenue, thus reducing the congestion on this facility. It is recommended that this be a two-lane facility.

**Horton Street Extension** - Extending Horton Street Extension north to NC 97 and forming an intersection with Horton Street is recommended in order to improve the town's road network. No capacity deficiencies are anticipated for this corridor.

### Construction Improvements and Cost Estimates

Construction priorities will vary depending on what criteria are considered and what weight is attached to the various criteria. Most people would agree that improvements to the major thoroughfare system and major traffic routes would be more

Zebulon Thoroughfare Plan Cost Estimates - Benefits - and Probable Impacts						
DESCRIPTION	LENGTH (mile)	CONST. COST	USER BENEFITS	ECONOMIC DEVELOPMENT	ENVIRONMENTAL IMPACTS	
					POSITIVE	NEGATIVE
NC 96 Bypass NC 96 (S. of Zebulon) - US 64 Bypass	3.55	5,680				
US 64 Bypass - NC 96 (N. of Zebulon)	<u>1.60</u>	<u>2,560</u>				
TOTAL	5.15	8,240	21,000	0.90	0.75	0.60
Southeast Inner Loop	1.11	1,443	18,400	0.70	0.60	0.50
Franklin Street NC 96 Bypass - Wakefield Street	0.89	1,157				
Wakefield Street - Arendell Ave (widen)	<u>0.27</u>	<u>216</u>				
TOTAL	1.16	1,373	39,450	0.75	0.75	0.50
NOTES: 1. Amounts are in \$ X 1000 2. Benefits are accrued over a 20 year time period.						

TABLE 3

important than minor thoroughfares where traffic volumes are lower. To be in the State's Transportation Improvement Program, a project must show favorable benefits relative to costs and should not be prohibitively disruptive to the environment. Based on these considerations the improvements shown in Table 3 were recommended.

### **Environmental Concerns**

The importance of addressing the environment is becoming increasingly apparent and there is a need to make every effort to preserve it. In looking at proposed thoroughfares it is desirable to locate a corridor that will have the least environmental impact. The Main environmental concerns that are examined at the thoroughfare plan stage are: the lay of the land, air quality, wetlands, water quality, wildlife, historic properties, neighborhoods, noise, schools, churches, and parks.

In developing the Recommended Thoroughfare Plan for the Town of Zebulon every effort was made to keep proposed facilities out of wetlands and to cross streams at a right angle. Widening Arendell Avenue and Gannon Avenue is an alternative, but would cause damage to neighborhoods and businesses along these streets. To minimize damage along these facilities other new construction and operational changes have been proposed. The Western Loop will help remove traffic from Arendell Avenue and Gannon Avenue, thus reducing the need to widen these major roads in Zebulon. The one-way pair (Gannon Avenue/Sycamore Street) will allow the east-west movement of traffic in Zebulon without extensive construction and widening that would be damaging to the environment.

The most critical area of concern is the Western Loop. This new facility encroaches the Little River watershed. Alternatives for the Western Loop that would keep it out of this watershed included going east of Zebulon. However, a facility to the east would not serve the desired travel patterns. Zebulon appears to be growing towards the west (Raleigh) and this is the most desirable location for a major thoroughfare. In addition moving the loop further west would not serve the people of Zebulon and therefore, would not be beneficial to the Town's road network.

One of the principle causes of lower air quality is traffic congestion. Therefore, implementing the Thoroughfare Plan, thereby reducing traffic congestion along Arendell Avenue and Gannon Avenue, will improve the area's air quality.

## V. ADMINISTRATIVE CONTROLS AND IMPLEMENTATION TOOLS

### State and Municipal Adoption of the Thoroughfare Plan

Chapter 136, Article 3A, Section 136-66.2 of the General Statutes of North Carolina provides that after development of a thoroughfare plan, the plan may be adopted by the governing body of the municipality and the Department of Transportation to serve as the basis for future street and highway improvements. The General Statutes also require that, as part of the plan, the governing body of the municipality and Department of Transportation shall reach agreement on responsibilities for existing and proposed streets and highways included in the plan. Facilities which are designated a State responsibility will be constructed and maintained by the Division of Highways. Facilities which are designated a municipal responsibility will be constructed and maintained by the municipality.

After mutual plan adoption, the Department of Transportation will initiate negotiations leading to determining which of the existing and proposed thoroughfares will be a Department responsibility and which will be a municipal responsibility. Chapter 136, Article 3A, Section 136-66.1 of the General Statutes provides guidance in the delineation of responsibilities. In summary, these statutes provide that the Department of Transportation shall be responsible for those facilities which serve volumes of through traffic and traffic from outside the area to major business, industrial, governmental, and institutional destinations located inside the municipality. The municipality is responsible for those facilities which serve primarily internal travel.

Unless implementation is an integral part of the transportation planning process, the effort and expense associated with developing a plan is lost. To neglect the implementation process is a three-fold loss: the loss of the capital expenditures used in developing a plan, the opportunity cost of the capital expenditures, and more importantly the loss of the benefits which would accrue from an improved transportation system.

Administrative controls and implementation tools which can aid in the implementation process are generally available to cities and municipalities through Federal and State Legislation. These controls and tools will be discussed in this chapter. They include: Subdivision Regulations, Zoning Ordinances, Official Maps, Urban Renewal, Capital Improvements Programs, and Development Reviews. Generally, two issues play a major role in the implementation process - available finances and citizen involvement. Effective use of the controls and tools listed below are indicative of good planning and minimize the effects of limited finances and negative citizen reaction to specific elements of a plan. It is through good planning that maximum use is made of every available dollar and that citizen involvement and approval of the transportation plan is obtained.

## Available Controls and Tools

### Subdivision Regulations

Subdivision regulations are locally adopted laws governing the process of converting raw land into building sites. From the planner's view, subdivision regulations are important at two distinct levels. First, they enable the area to coordinate the otherwise unrelated plans of a great many individual developers. This process assures that provision is made for land development elements such as roadway right-of-way, parks, school sites, water lines and sewer outfalls, and so forth. Second, they enable the area to control the internal design of each new subdivision so that its pattern of streets, lots, and other facilities will be safe, pleasant, and economical to maintain.

To be most effective, subdivision regulations and their administration must be closely coordinated with other local governmental policies and ordinances. Among the more important of these are the Comprehensive Growth Plan, Utilities Extension Master Plan, and Thoroughfare Plan.

In practice, subdivision regulations can provide some very positive benefits such as requiring portions of major streets to be constructed in accordance with the Thoroughfare Plan, or requiring subdividers to provide for the dedication and/or reservation of rights-of-way in advance of construction. These practices reduce the overall cost of the plan by having some costs borne by developers. The proposed NC 96 Bypass, as well as the Southeast Inner Loop, could benefit from the implementation of subdivision regulations to reserve right-of-way or possibly build sections of this facility.

Recommended Subdivision Ordinances are included in Appendix B.

### Zoning Ordinances

Zoning is probably the single most commonly used legal device available for implementing a community's land-use plan. To paraphrase the U.S. Department of Commerce 1924 Standard Zoning Enabling Act, on which most present-day legislation is based, zoning may be defined as the division of a municipality (or other governmental unit) into districts, and the regulation within the districts of:

1. the height and bulk of buildings and other structures,
2. the area of a lot which may be occupied and the size of required open spaces,
3. the density of population, and
4. the use of buildings and land for trade, industry, residence, or other purposes.

The characteristic feature of the zoning ordinance that distinguishes it from most other regulations is that it differs from district to district, rather than being uniform throughout a

city. Thus, a given area might be restricted to single-family residential development with minimum lot size requirements and setback provisions appropriate for development. In other areas, commercial or industrial development might be permitted, and regulations would be enacted to control such development. Building code provisions or sanitary regulations, on the other hand, normally apply to all buildings in a certain category regardless of where they may be situated within a city.

The zoning ordinance does not regulate the design of streets, utility installation, the reservation or dedication of parks, street rights-of-way, school sites, and related matters. These are controlled by subdivision regulations or possibly by use of an official map. The zoning ordinance should, however, be carefully coordinated with these and other control devices.

### **Official Maps**

The roadway corridor official map (or official map) is a document, adopted by the legislative body of the community, that pinpoints and preserves the location of proposed streets against encroachment. In effect, the official map serves notice on developers that the State or municipality intends to acquire certain specific property. The official map serves as a positive influence for sound development by reserving sites for public improvements in anticipation of actual need. The proposed NC 96 Bypass is an example of a proposed project that could be protected by using an official map.

The NCDOT position is that it will limit the use of official maps to large scale, fully access controlled facilities planned for rapidly developing areas outside of municipal jurisdictions. For projects within municipal jurisdictions, official maps should be prepared and adopted by the local government. Municipalities may adopt official maps that extend beyond their extraterritorial jurisdiction with approval from the Board of County Commissioners.

It should be recognized that an official map places severe but temporary restrictions on private property rights. These restrictions are in the form of a prohibition, for up to three years, on the issuance of building permits or the approval of subdivisions on property lying within an official map alignment. The three year reservation period begins with the request for development approval. This authority should be used carefully and only in cases where less restrictive powers are found to be ineffective.

Requests for NCDOT to prepare and adopt an official map should be directed to the director of the Program, Policy, and Budget. For cities contemplating the adoption of an official map, there are two ways in which the city may proceed. The first is to consider the official map statute as a stand-alone authority and use it as the basis for local adoption of an official map. Alternatively, the second approach is to adopt a local ordinance modeled after the statute, but modified to fit local circumstances

and to clarify the statute. Regardless of the approach taken, several procedural steps will need to be considered, such as establishing procedures for consideration of variance petitions.

Once the project has been selected and the alignment determined, maps must be prepared that are suitable for filing with the county Register of Deeds' Office. The map should show the proposed alignment in sufficient detail to identify the functional design and the preliminary right-of-way boundaries. Since the purpose of the map is to show the effect on properties along the project path, the existing property boundaries should be identified. As an additional requirement, within one year of the adoption of an official map, work must begin on an environmental impact study or preliminary engineering work must begin.

It is important to recognize the risks inherent in the adoption of an official map prior to completing the environmental studies. Projects using any federal funds require the unbiased evaluation of alternative alignments. This means several alternatives will be studied and compared to the protected alignment.<sup>1</sup>

The above information is only to serve as an introduction to official maps, and in no way provides the information necessary to begin development of an official map. The Program Development Branch of the North Carolina Department of Transportation is responsible for facilitating the adoption of Official Street Maps. Cities considering Official Street Map projects should contact this Branch for their "Guidelines for Municipalities Considering Adoption of Roadway Corridor Official Maps" at:

Program Development Branch  
NC Department of Transportation  
P.O. Box 25201  
Raleigh, North Carolina 27611

### **Urban Renewal**

Urban renewal plays a minor role in the transportation planning implementation process in terms of scope and general influence. However, under the right circumstances, renewal programs can make significant contributions. Provisions of the New Housing Act of 1974 (as amended) call for the conservation of good areas, rehabilitation of declining areas, and clearance of slum areas. In the course of renewal, it is important to coordinate with the Thoroughfare Plan to see if additional set-backs or dedication of rights-of-way are needed.

Continued use of urban renewal programs to improve the transportation system is encouraged. Changes that can be made under this program are generally not controversial or disruptive given the trauma of the clearance of a significant area.

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<sup>1</sup> "Guidelines for Municipalities Considering Adoption of Roadway Corridor Official Maps", prepared by NCDOT Program Development Branch.



## **Capital Improvement Programs**

Capital programs are simply the coordination of planning and money. The Capital Improvements Program, with respect to transportation, is a long range plan for the spending of money on street improvements, acquisition of rights-of-way and other improvements within the bounds of projected revenues. Municipal funds should be available for construction of street improvements which are a municipal responsibility, right-of-way cost sharing on facilities designated a Division of Highways responsibility and advance purchase of right-of-way where such action is warranted.

Historically cities and towns have depended, to a great degree, on Federal or State funding to solve their transportation problems. Chapter 136-Article 3A of the Road and Highway Laws of North Carolina clearly outlines the responsibilities and obligations of the various governmental bodies regarding highway improvements. North Carolina Highway Bill 1211, passed in 1988, limits the role of municipalities to specific limits in right-of-way cost sharing. Set-back regulations, right-of-way dedications and reservations play a major role in the ultimate cost of many facilities. Only in special cases will the municipality be able to enjoy the benefits of highway improvement without some form of investment.

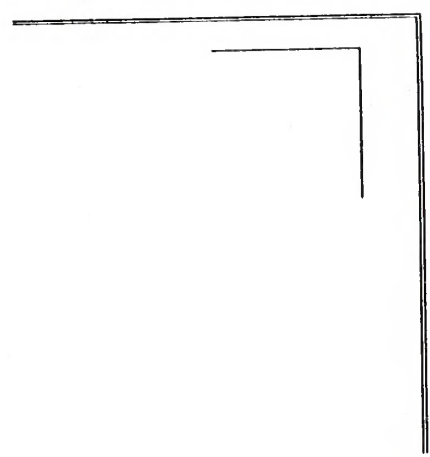
## **Development Reviews**

Driveway access to a State-maintained street or highway is reviewed by the District Engineer's office and by the Traffic Engineering Branch of the North Carolina Department of Transportation prior to access being allowed. Any development expected to generate large volumes of traffic (i.e. shopping centers, fast food restaurants, large industries, etc.) may be comprehensively studied by staff from the Traffic Engineering, Planning and Environmental, Statewide Planning, and Roadway Design Branches of NCDOT. If done at an early stage, it is often possible to significantly improve the development's accessibility at minimal expense. Since the municipality is the first point of contact for developers, it is important that the municipality advise them of this review requirement and cooperate in the review process.

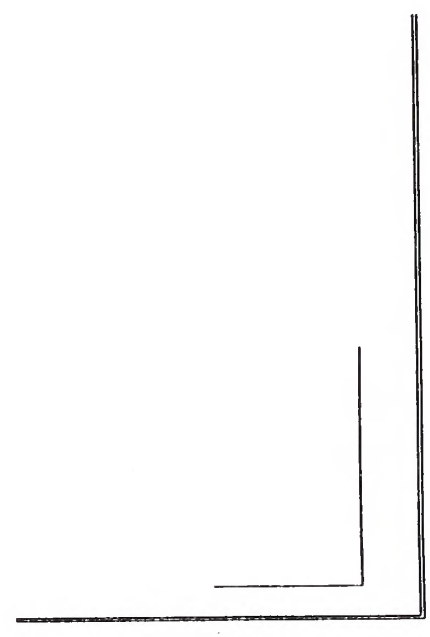
## **Other Funding Sources**

1. Assess user impact fees to fund transportation projects. These fees, called "facility fees" in the legislation, are to be based upon "reasonable and uniform considerations of capital costs to be incurred by the town as a result of new construction. The facility fee must bear a direct relationship to additional or expanded public capital costs of the community service facilities to be rendered for the inhabitants, occupants of the new construction, or those associated with the development process."

2. Enact a bond issue to fund street improvements.
3. Continue to work with NCDOT to have local projects included in the Transportation Improvement Program (TIP).
4. Consider the possibility of specific projects qualifying for federal demonstration project funds.
5. Adopt a collector street plan that would assess buyer or property owners for street improvement.
6. Charge a special assessment for utilities; for example, increase water and sewer bills to cover cost of street improvements.



***APPENDICES***





## APPENDIX A

### Typical Cross Sections

Typical cross sections recommended by the Thoroughfare Planning Unit appear in Appendix A, Figure 7, and listed in Appendix A, Table 4.

Cross section "A" is illustrative for controlled access freeways. The 46-foot grassed median is the least desirable median width, but there could be some variation from this depending upon design considerations. Slopes of 8:1 into 3 foot drainage ditches are desirable for traffic safety. Right-of-way requirements would typically vary upward from 250 feet depending upon cut and fill requirements.

Cross section "B" is typical for four-lane divided highways in rural areas which may have only partial or no control of access. The minimum median width for this cross section is 30 feet, but a wider median is desirable. Design requirements for slopes and drainage would be similar to cross section "A," but there may be some variation from this depending upon right-of-way constraints.

Cross section "C," seven-lane urban, and cross section "D," five lane urban, are typical for major thoroughfares where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

Cross sections "E" and "F" are used on major thoroughfares where left turns and intersecting streets are not as frequent. Left turns would be restricted to a few selected intersections.

Cross section "G" is recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 24 feet is recommended with 30 feet being desirable.

Typical cross section "H" is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane would probably be required at major intersections.

Thoroughfares which are proposed to function as one-way traffic carriers would typically require cross section "I." Cross section "J" and "K" are usually recommended for minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross section "J" would be used on those minor thoroughfares where parking on both sides is needed as a result of more concentrated development.

Cross section "L" is used in rural areas or for staged construction of a wider multi-lane cross section. On some thoroughfares projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time.

The curb and gutter urban cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum right-of-way line. This permits adequate setback for utility poles. If greater separation between the road and the sidewalk is desired for pedestrian safety or aesthetics, additional right-of-way must be provided to insure adequate setback for utility poles.

Rights-of-way shown for the typical cross sections are the minimum rights-of-way required to contain the street, sidewalks, utilities, and drainage facilities. Cut and fill requirements may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

If there is sufficient bicycle traffic along the thoroughfare to justify a bicycle lane or bikeway, additional right-of-way may be required to allow for the bicycle facilities. The North Carolina Bicycle Facility and Program Handbook should be consulted for design standards for bicycle facilities.

Recommended typical cross sections for thoroughfares were derived on the basis of projected traffic, existing capacities, desirable levels of service and available right-of-way.

# TYPICAL THOROUGHFARE CROSS SECTIONS

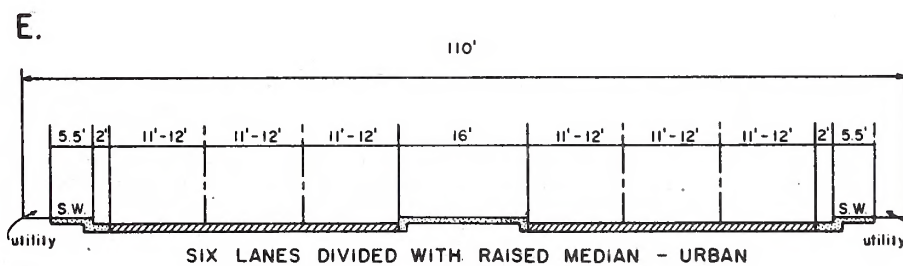
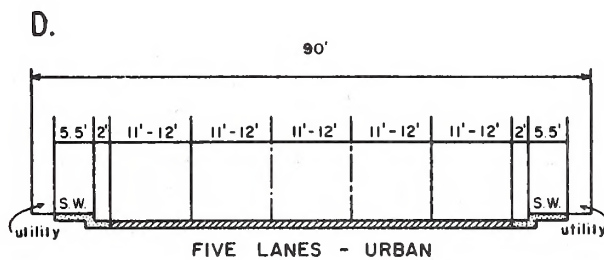
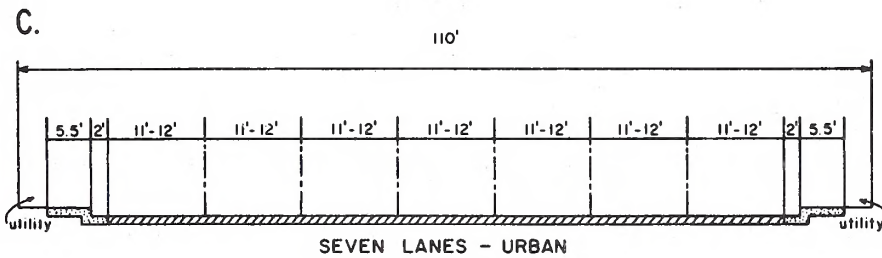
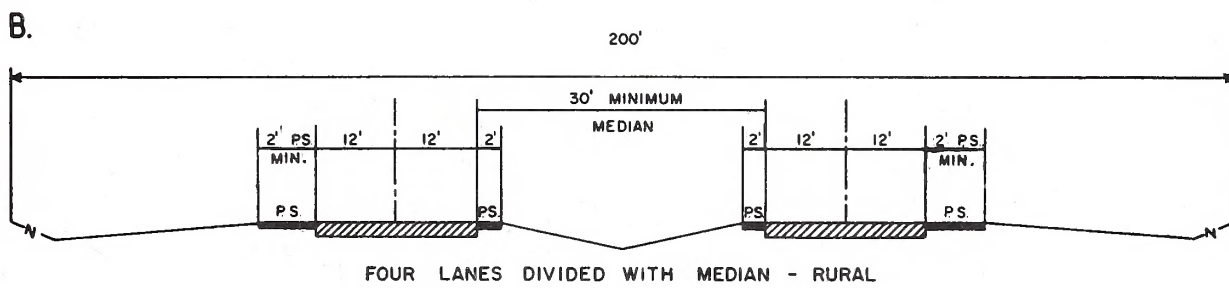
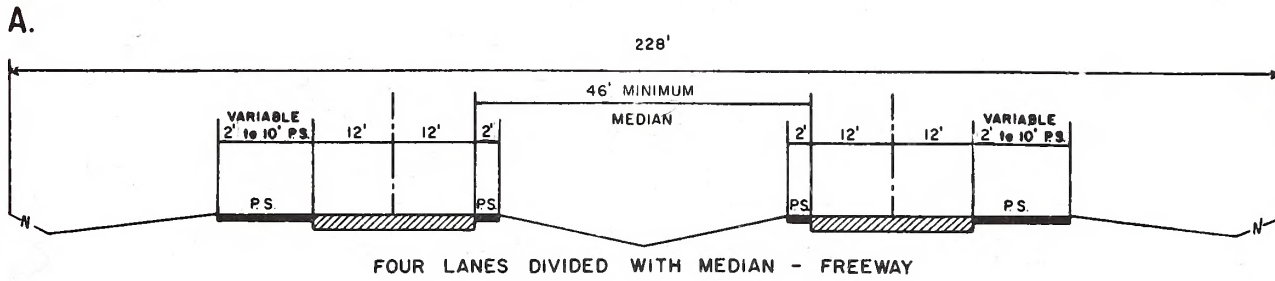
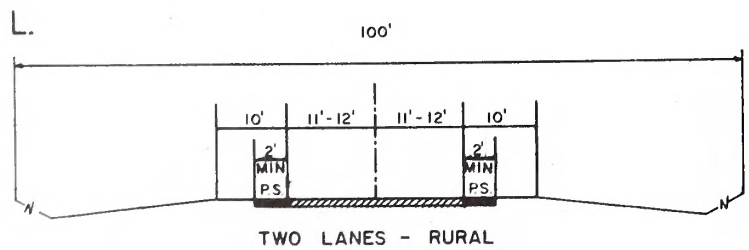
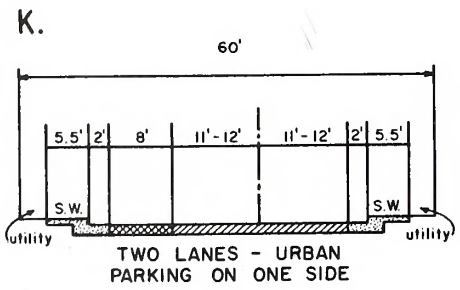
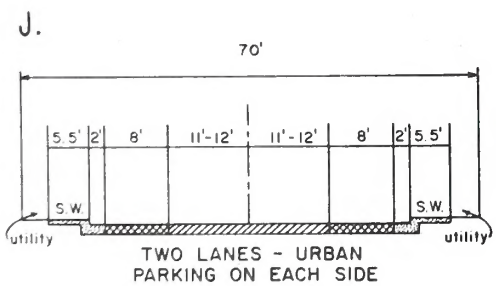
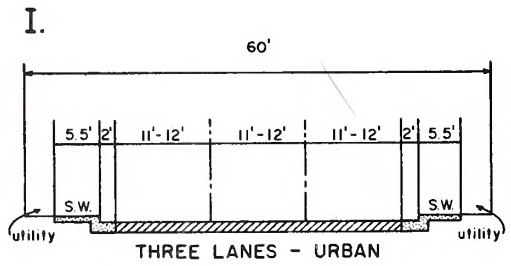
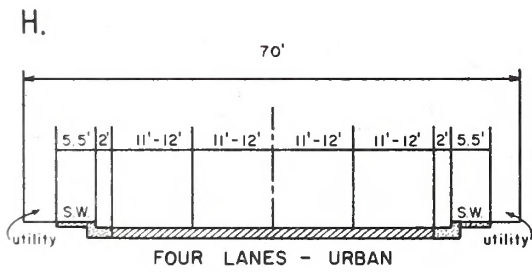
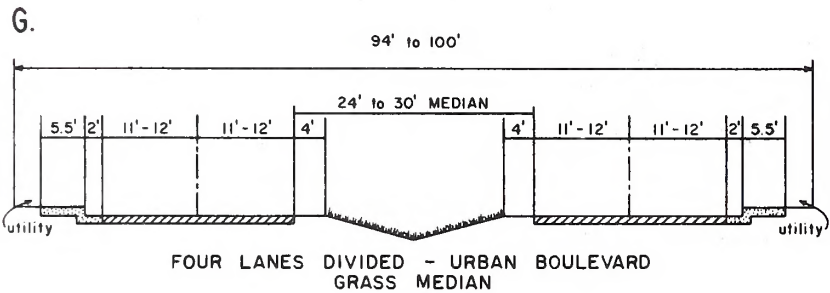
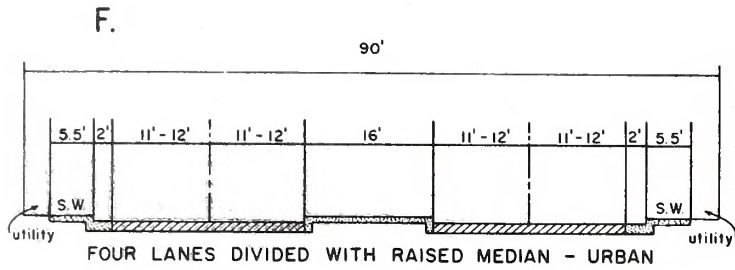


FIGURE 7

# TYPICAL THOROUGHFARE CROSS SECTIONS (CONTINUED)





**THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS**

FACILITY & SECTION	EXISTING X - SECTION			CAPACITY (FUTURE) {ULT} [ONEWAY]	VOLUMES ADT			RECOMMENDED X - SECTION	
	DIST MI	RDWY FT	ROW FT		1989	2015	2015 W/PLAN	RDWAY {ULT}	ROW {ULT}
<b>US 64 Bypass</b>									
Planning Boundary - Prop NC 96 Bypass	0.57	48 (4L)	200	54,000	21,000	38,000	38,000	ADQ	---
Prop NC 96 Bypass - Arendell Ave	1.41	48 (4L)	290	54,000	21,000	30,300	38,000	ADQ	---
Arendell Ave - US 264	0.97	48 (4L)	290	54,000	17,800	34,000	34,000	ADQ	---
US 264 - Planning Boundary	1.30	48 (4L)	290	54,000	9,500	17,000	17,000	ADQ	---
<b>US 264</b>									
US 64 - Gannon Ave	1.82	48 (4L)	300	54,000	9,200	16,800	16,800	ADQ	---
Gannon Ave - Planning Boundary	0.24	48 (4L)	410	54,000	8,300	14,700	14,700	ADQ	---
<b>US 64 Business</b>									
Planning Boundary - Gannon Ave	1.82	24 (2L)	60	12,000	4,700	8,000	7,500	ADQ	---
Gannon Ave - Liberty St	0.10	40 (3L)	NA	14,000	14,100	24,000	20,600	ADQ	---
Liberty St - Wakefield St	0.14	40 (3L)	NA	[14,000]	14,100	24,000	10,300	ADQ	---
Wakefield St - Arendell Ave	0.28	30 (3L)	NA	[14,000]	12,200	20,400	10,300	ADQ	---
Arendell Ave - Lee St	0.26	40 (2L)	60	{14,000}	10,700	26,000	18,300	D	ADQ
Lee St - Judd St	0.27	44 (4L)	60	20,000	10,700	26,000	18,300	D	ADQ
Judd St - US 64 Bypass	0.26	68 (5L)	100	24,000	10,700	26,000	17,000	ADQ	---
<b>NC 96 (Arendell Ave)</b>									
Planning Boundary - City Limits	1.12	20 (2L)	60	9,500	2,000	3,300	3,700	WI	ADQ
City Limit - Barbee St	0.24	44 (2L)	60	12,000	2,900	8,000	4,300	ADQ	---
Barbee St - Gannon Ave	0.34	40 (2L)	60	9,000	6,500	12,300	9,000	I	ADQ
Gannon Ave - US 64 Byp	Common US 64 Business								
US 64 Byp - Hendricks Dr	0.27	68 (4L)	100	20,000	8,200	20,000	12,400	ADQ	---
Hendricks Dr - Planning Boundary	1.04	21 (2L)	100	12,000	NA	15,000	9,000	WI	ADQ

CAPACITY is "practical capacity" as defined by level of service "D"

- ADQ - Adequate
- NA - Information Not Available
- WI - Widen to allow for 12 ft. lanes

**TABLE 4**

**THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS**

FACILITY & SECTION	EXISTING X - SECTION			CAPACITY (FUTURE) {ULT} [ONEWAY]	VOLUMES ADT			RECOMMENDED X - SECTION	
	DIST MI	RDWY FT	ROW FT		1989	2015	2015 W/PLAN	RDWAY {ULT}	ROW {ULT}
<b>NC 97 (Gannon Ave)</b>									
Planning Boundary - SR 2370	0.85	24 (2L)	100	12,000	NA	----	----	ADQ	---
SR 2370 - US 64 Bus	1.61	22 (2L)	100	11,000	9,600	16,000	12,000	WI	ADQ
US 64 Bus - Arendell Ave				Common					
Arendell Ave - Old US 64	0.06	36 (3L)	NA	13,000	7,800	20,400	11,000	ADQ	---
Old US 64 - SR 2404	1.15	24 (2L)	100	12,000	3,400	5,600	4,000	ADQ	---
SR 2404 - Planning Boundary	0.80	24 (2L)	100	12,000	NA	----	----	ADQ	---
<b>Prop NC 96 Bypass</b>									
Arendell Ave - Wakefield St	0.34	--	---	{35,000}	--	-0-	7,200	{G}	{100}
Wakefield St - Barbee St	0.46	--	---	{35,000}	--	-0-	6,500	{G}	{100}
Barbee St - US 64 Bus	0.67	22 (2L)	NA	{35,000}	NA	3,000	7,500	{G}	{100}
US 64 Bus - Gannon Ave	1.03	--	---	{35,000}	--	-0-	8,500	{G}	{100}
Gannon Ave - Franklin St Ext	0.28	--	---	{35,000}	--	-0-	12,300	{G}	{100}
Franklin St Ext US 64 Bypass	0.77	--	---	{35,000}	--	-0-	9,700	{G}	{100}
US 64 Bypass - Riley Hill Rd	0.50	--	---	{35,000}	--	-0-	2,000	{G}	{100}
Riley Hill Rd - Arendell Ave	1.10	--	---	{35,000}	--	-0-	1,500	{G}	{100}
<b>Barbee St (SR 2348)</b>									
Prop NC 96 Bypass - Wakefield St	0.49	22 (2L)	NA	11,000	1,300	1,700	5,300	WI	60
Wakefield St - Arendell Ave	0.26	26 (2L)	NA	10,000	1,600	2,000	4,000	ADQ	---
Arendell Ave - Whitley Dr	0.24	26 (2L)	NA	10,000	1,200	1,300	1,500	ADQ	---
Whitley Dr - Southeast Inner Loop	0.45	26 (2L)	NA	10,000	--	-0-	1,500	ADQ	---
<b>Franklin St</b>									
Prop NC 96 Bypass - Wakefield St	0.89	--	--	(12,000)	NA	----	6,200	J	70
Wakefield St - Arendell Ave	0.27	22 (2L)	NA	(12,000)	NA	----	5,000	J	70

CAPACITY is "practical capacity" as defined by level of service "D"

ADQ - Adequate

NA - Information Not Available

WI - Widen to allow for 12 ft. lanes

**TABLE 4 cont.**

**THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS**

FACILITY & SECTION	EXISTING X - SECTION			CAPACITY (FUTURE) {ULT} [ONEWAY]	VOLUMES ADT			RECOMMENDED X - SECTION	
	DIST MI	RDWY FT	ROW FT		1989	2015	2015 W/PLAN	RDWY {ULT}	ROW {ULT}
<b>Green Pace Rd (SR 2368)</b> Planning Boundary - Proctor St	2.60	18 (2L)	NA	7,000	1,000	1,700	4,400	WI	60
<b>Horton St (SR 2345)</b> Wakefield St - Church St	0.15	24 (2L)	NA	10,000	1,200	1,500	2,800	ADQ	---
Church St - Arendell Ave	0.12	36 (2L)	NA	11,000	1,200	1,500	2,800	ADQ	---
Arendell Ave - Poplar St	0.13	36 (2L)	60	11,000	1,200	1,500	2,800	ADQ	---
Poplar St - Southeast Inner Loop	0.55	18 (2L)	60	7,000	500	650	1,500	WI	60
<b>Horton St Ext (SR 2345)</b> Southeast Inner Loop - Planning Boundary	1.33	18 (2L)	NA	7,000	NA	----	----	WI	60
<b>Judd St</b> Wakefield St - Church St	0.15	20 (2L)	NA	(12,000)	NA	----	3,000	K	60
Church St - Arendell Ave	0.12	26 (2L)	NA	12,000	NA	----	3,000	ADQ	---
Arendell Ave - Old US 64	0.28	24 (2L)	NA	12,000	NA	----	2,500	ADQ	---
<b>Old US 64 (SR 2406)</b> Gannon Ave - Glenn St	0.17	24 (2L)	60	12,500	4,800	8,000	7,200	ADQ	---
Glenn St - US 64 Bypass	0.45	36 (2L)	60	13,000	NA	---	7,200	ADQ	---
US 64 Bypass - Proctor St	0.31	24 (2L)	100	13,000	4,000	5,800	6,000	ADQ	---
Proctor St - Planning Boundary	0.87	20 (2L)	100	8,000	4,000	5,800	6,000	WI	ADQ
<b>Proctor St (SR 2320)</b> Arendell Ave - Gannon Ave	2.84	20 (2L)	NA	8,000	1,200	2,000	2,500	WI	60

CAPACITY is "practical capacity" as defined by level of service "D"

- ADQ - Adequate
- NA - Information Not Available
- WI - Widen to allow for 12 ft. lanes

**TABLE 4 cont.**

THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

FACILITY & SECTION	EXISTING X - SECTION			CAPACITY (FUTURE) {ULT} [ONEWAY]	VOLUMES			RECOMMENDED X - SECTION	
	DIST MI	RDWY FT	ROW FT		1989	ADT 2015	2015 W/PLAN	RDWAY {ULT}	ROW {ULT}
<b>Southeast Inner Loop</b>									
Arendell Ave - Barbee St	0.81	--	--	(12,000)	---	-0-	4,500	J	70
Barbee St - Gannon Ave	0.30	--	--	(12,000)	---	-0-	3,800	J	70
<b>SR 1001</b>									
Arendell Ave - Planning Boundary	0.85	18 (2L)	60	7,000	2,200	3,700	3,200	WI	ADQ
<b>Sycamore Street</b>									
US 64 Bus - Wakefield St	0.15	--	NA	[14,000]	---	-0-	10,300	J	70
Wakefield St - Gannon Ave	0.61	24 (2L)	NA	[14,000]	NA	4,300	10,300	J	70
<b>Wakefield St (SR 2349)</b>									
Planning Boundary - Sycamore St	1.56	22 (2L)	NA	(12,000)	2,200	4,300	5,300	K	60
Sycamore St - Gannon Ave	0.10	32 (2L)	NA	12,000	NA	4,300	5,300	ADQ	---
Gannon Ave - Judd St	0.50	18 (2L)	NA	(12,000)	NA	----	3,750	K	60
<b>Whitley Ave.</b>									
Barbee St - Vance St	0.10	--	--	(12,000)	--	-0-	1,000	K	60
Vance St - Gannon Ave	0.2	20 (2L)	NA	(12,000)	400	800	1,000	K	60

CAPACITY is "practical capacity" as defined by level of service "D"

ADQ - Adequate

NA - Information Not Available

WI - Widen to allow for 12 ft. lanes

TABLE 4 cont.

**APPENDIX B**  
**RECOMMENDED SUBDIVISION ORDINANCES**

**DEFINITIONS**

I. Streets and Roads:

A. Rural Roads

1. Principal Arterial - A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.
2. Minor Arterial - A rural roadway joining cities and larger towns and providing intra-state and inter-county service at relatively high overall travel speeds with minimum interference to through movement.
3. Major Collector - A road which serves major intra-county travel corridors and traffic generators and provides access to the Arterial system.
4. Minor Collector - A road which provides service to small local communities and traffic generators and provides access to the Major Collector system.
5. Local Road - A road which serves primarily to provide access to adjacent land, over relatively short distances.

B. Urban Streets

1. Major Thoroughfares - Major thoroughfares consist of Interstate, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.
2. Minor Thoroughfares - Minor thoroughfares perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through-traffic movements and may also serve abutting property.
3. Local Street - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

### C. Specific Type Rural or Urban Streets

1. Freeway, expressway, or parkway - Divided multilane roadways designed to carry large volumes of traffic at high speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. An expressway is a facility with full or partial control of access and generally with grade separations at major intersections. A parkway is a for non-commercial traffic, with full or partial control of access.
2. Residential Collector Street - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.
3. Local Residential Street - Cul-de-sacs, loop streets less than 2,500 feet in length, or streets less than one mile in length that do not connect thoroughfares, or serve major traffic generators, and do not collect traffic from more than 100 dwelling units.
4. Cul-de-sac - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.
5. Frontage Road - A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.
6. Alley - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

### II. Property

- A. Building Setback Line - A line parallel to the street in front of which no structure shall be erected.
- B. Easement - A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.
- C. Lot - A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. The word "lot" includes the words "plat" and "parcel".

### III. Subdivision

- A. Subdivider - Any person, firm, corporation or official agent thereof, who subdivides or develops any land deemed to be a subdivision.

- B. Subdivision - All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development and all divisions of land involving the dedication of a new street or change in existing streets; provided, however, that the following shall not be included within this definition nor subject to these regulations: (1) the combination or recombination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein; (2) the division of land into parcels greater than ten acres where no street right-of-way dedication is involved, (3) widening of opening of streets; (4) the division of a tract in single ownership whose entire area is no greater than two acres into not more than three lots, where no street right-of-way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.
- C. Dedication - A gift, by the owner, of his property to another party without any consideration being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.
- D. Reservation - Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

## DESIGN STANDARDS

### I. Streets and Roads

The design of all roads within Zebulon shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the Town of Zebulon.

The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

- A. Right-of-way Widths - Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set in the Thoroughfare Plan.

1. Rural	Min. ROW
a. Principal Arterial	
Freeways	350 ft.
Other	200 ft.
b. Minor Arterial	100 ft.
c. Major Collector	100 ft.
d. Minor Collector	80 ft.
e. Local Road	60 ft. <sup>1</sup>
2. Urban	
a. Major Thoroughfare other than Freeway and Expressway	90 ft.
b. Minor Thoroughfare	70 ft.
c. Local Street	60 ft. <sup>1</sup>
d. Cul-de-sac	Variable <sup>2</sup>

The subdivider will only be required to dedicate a maximum of 100 feet of right-of-way. In cases where over 100 feet of right-of-way is desired, the subdivider will be required only to reserve the amount in excess of 100 feet. On all cases in which right-of-way is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principal and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width right-of-way, not less than sixty feet in width, may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider, provided the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is subdivided, the remainder of the full required right-of-way shall be dedicated.

- B. Street Widths - Widths for street and road classifications other than local shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

---

<sup>1</sup> The desirable minimum right-of-way (ROW) is 60 ft. If curb and gutter is provided, 50 feet of ROW is adequate on local residential streets.

<sup>2</sup> The ROW dimension will depend on radius used for vehicular turnaround. Distance from edge of pavement of turnaround to ROW should not be less than distance from edge of pavement to ROW on street approaching turnaround.



1. Local Residential  
Curb and Gutter section: 26 feet, face to face of curb  
Shoulder section: 20 feet to edge of pavement, 4 foot  
shoulders
  2. Residential Collector  
Curb and Gutter section: 34 feet, face to face of curb  
Shoulder section: 20 feet to edge of pavement, 6 foot  
shoulders
- C. Geometric Characteristics - The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-Way shall apply.
1. Design Speed - The design speed for a roadway should be a minimum of 5 mph greater than the posted speed limit. The design speeds for subdivision type streets shall be:

<b>DESIGN SPEEDS</b>			
Facility Type	<u>Design Speed</u>		
	Desirable	Minimum Level	Rolling
<b>RURAL</b>			
Minor Collector Roads	60	50	40
Local roads including Residential Collectors and Local Residential	50	50 <sup>1</sup>	40 <sup>1</sup>
<b>URBAN</b>			
Major Thoroughfares other than Freeway or Expressway	60	50	50
Minor Thoroughfares	60	50	40
Local Streets	40	40 <sup>2</sup>	30 <sup>2</sup>

<sup>1</sup> Based on projected annual average daily traffic of 400-750. In cases where road will serve a limited area and small number of dwelling units, minimum design speeds can be reduced further.

<sup>2</sup> Based on projected annual average daily traffic of 50-250.

2. Maximum and Minimum Grades

a. The maximum grades in percent shall be:

MAXIMUM VERTICAL GRADE		
Design Speed	Terrain	
	Level	Rolling
60	4	5
50	5	6
40	6	7
30		9

b. Minimum grade should not be less than 0.5% .

c. Grades for 100 feet each way from intersections (measured from edge of pavement) should not exceed 5%.

d. For streets and roads with projected annual average daily traffic less than 250 short grades, less than 500 feet long, may be 150% of the value in the above table.

3. Minimum Sight Distance - In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the following parameters:

SIGHT DISTANCE				
Design Speed	30	40	50	60
Stopping Sight Distance				
Minimum (ft.)	200	275	400	525
Desirable Minimum (ft.)	200	325	475	650
Minimum $K^1$ Value for:				
Crest curve	30	80	160	310
Sag curve	40	70	110	160

(General practice calls for vertical curves to be multiples of 50 feet. Calculated lengths shall be rounded up in each case.)

<sup>1</sup> K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in feet of the vertical curve which will provide the desired sight distance.

Sight distance provided for stopped vehicles at intersections should be in accordance with "A Policy on Geometric Design of Highways and Streets, 1984".

4. The "Superelevation Table" below shows the maximum degree of curve and related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter of 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

<b>SUPERELEVATION TABLE</b>			
Design Speed	Maximum e*	Minimum Radius ft.	Max. Deg. of Curve.
30	0.04	302	19° 00'
40	0.04	573	10° 00'
50	0.04	955	6° 00'
60	0.04	1,528	3° 45'
30	0.06	273	21° 00'
40	0.06	509	11° 15'
50	0.06	849	6° 45'
60	0.06	1,380	4° 15'
30	0.08	252	22° 45'
40	0.08	468	12° 15'
50	0.08	764	7° 30'
60	0.08	1,206	4° 45'

e\* = rate of roadway superelevation, foot per foot

#### D. Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees.
2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.
3. Off-set intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 200 feet between survey centerlines.

E. Cul-de-sacs

Cul-de-sacs shall not be more than seven hundred (700) feet in length. the distance from the edge of pavement on the vehicular turnaround to the right-of-way line should not be less than the distance from the edge of pavement to right-of-way line on the street approaching the turnaround. Cul-de-sacs should not be used to avoid connection with an existing street or to avoid the extension of an important street.

F. Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provision is made for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.
2. The width of an alley shall be at least twenty (20) feet.
3. Dead-end alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turnaround facilities at the dead-end as may be required by the Planning Board.

G. Permits For Connection To State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division of Highways.

H. Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 30 feet from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 6 feet from the face of curb.

I. Wheel Chair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

J. Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2-lane, 2-way traffic should be as follows:

a. Shoulder section approach

i. Under 800 ADT design year

Minimum 28 feet width face to face of parapets or rails or pavement width plus 10 feet, whichever is greater.

ii. 800 - 2000 ADT design year

Minimum 34 feet width face to face of parapets or rails or pavement width plus 12 feet, whichever is greater.

iii. Over 2000 ADT design year

Minimum width of 40 feet, desirable width of 44 feet width face to face of parapets or rails.

b. Curb and gutter approach

i. Under 800 ADT design year

Minimum 24 feet face to face of curbs.

ii. Over 800 ADT design year

Width of approach pavement measured face to face of curbs.

Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be 1'6" minimum, or greater if sidewalks are required.

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

a. Shoulder section approach - Width of approach pavement plus width of usable shoulders on the approach left and right. (Shoulder width 8' minimum, 10' desirable.)

b. Curb and gutter approach - Width of approach pavement measured face to face of curbs.

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